

A visionary scientist, scientific adventurer and explorer

# Mario Wiesendanger

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Professor Mario Wiesendanger was known and esteemed internationally for his research on motor control. His passing is a great loss for all. For several established neuroscientists working in this field, he, both as a person and through his work, had a considerable and stimulating influence.

After his medical studies at the University of Zurich (1950–1957), Mario Wiesendanger worked in this same institution with Professor M. Mumenthaler, where he specialized in clinical neurology and neurophysiology (1958–1962). Using mainly electromyography (EMG), he studied various neuromuscular diseases, including diabetic neuropathy, ocular neuropathy, peripheral nerve injury and myasthenia gravis. Meanwhile, in 1959, he obtained his MD degree.

His clinical training was complemented by a 2-year stay in Copenhagen (1962–1964) at the Institute of Neurophysiology, where Mario Wiesendanger had the opportunity to work with Professor F. Buchthal, an expert in muscle physiology and electromyography. He conducted quantitative electromyographic studies in human subjects and animals. By means of an anesthetized cat model, he and his colleagues investigated the action of the pyramidal tracts on alpha and gamma motoneurons, as replicated in muscles, and the pathophysiology of deafferentation and transection of the bulbar pyramids (pyramidotomy).

In 1964 Mario Wiesendanger came back to Zurich as first assistant and head of the neurophysiological section of the Brain Research Institute recently created by Professor Konrad Akert. He set up a laboratory of experimental neurophysiology, and with several collaborators explored many previously unknown fields, focusing on motor cortex on various subcortical regions and the spinal cord. Mario Wiesendanger obtained the habilitation in 1968 and was promoted assistant professor in 1970. His research was first focused on cortical and then on pyramidal influence on the trigeminal pain pathway at the spinal and brain stem levels, on the brain stem relay of the sensory pathway, on alpha and gamma motoneurons, and on presynaptic inhibition. During that time, he and his collaborators performed experiments that sometimes lasted 24 hours. Most important is still his publication of his habilitation thesis, in 1969 in “Ergebnisse der Physiologie”: “The Pyramidal Tract. Recent Investiga-

tions on its Morphology and Function”. It was an outstanding review with 286 references, providing historical and contemporary knowledge as well as discussion of future avenues for research.

Mario Wiesendanger was indeed a visionary scientist, creative and original, who rapidly generated new projects which his collaborators did not always immediately understand, as they did not possess the depth of scientific knowledge he had already acquired. His interests were expanding with two essential new aspects of the role of the motor cortex in motor control orienting his research. The first concerned sensory inputs to the motor cortex, namely the visual input, a topic he investigated as a visiting scientist in the laboratory of Professor Pierre Buser in Paris and the cortical representation of proprioception, which he studied in Oxford with Professor Charles Phillips. The second interest was focused on the ongoing discussion of the “pyramidal syndrome”, i.e. the question of spasticity after motor cortical lesions in patients. The presence of spasticity was tested and rejected in monkeys subjected to pyramidotomy after training in a precision grip task. The quantitative assessment of deficits and recovery was one of the most relevant new findings of this period.

In 1972 Mario Wiesendanger was appointed as a tenured associate professor at the University of Western Ontario in London, Canada, where he moved with his whole family (his wife Rita and their four daughters), taught and continued his research. Very eclectic, as he was throughout his career: He contributed to further research on the physiology of the cerebellum and of the trigeminal input to the inferior olive. He also collaborated in neuronal recording of the motor cortex of monkeys trained to perform arm flexion and extension.

In 1975, the family crossed back over the Atlantic when he took the position of associate and then, two years later, of full professor of Neurophysiology (a newly created chair) at the Institute of Physiology of the University of Fribourg (Switzerland). With his characteristic enthusiasm, he introduced an outstanding teaching program on brain function for medical students, centered on the students’ needs and tailored to stimulate their interest and curiosity for basic neural and physiological mechanisms, as well as re-

lated clinical aspects. A major achievement in the area of research was to successfully install in Fribourg the infrastructure necessary to employ non-human primates for the investigation of the motor control of voluntary movements, with an emphasis on manual dexterity, a faculty specific to primates. Mario Wiesendanger quickly demonstrated his great expertise and, with the crucial contribution of his wife Rita and valued collaborators, became a predominant figure in the field of motor control in general and of the supplementary motor area (SMA) in particular. Before several other laboratories, he reported the functional and anatomical connections of the SMA, with a rostral part, the pre-SMA, being distinct from its caudal part, the SMA-proper. While most scientists investigating motor control studied unimanual movement, Mario Wiesendanger was a pioneer in studying the neural control of bimanual movements, the perfect coordination of the two hands in both spatial and temporal domains, e.g. when playing an instrument like the violin, another passion of Mario. To further investigate bimanual control, he created the “reach and grasp drawer task” which was first applied to monkeys, then to healthy human subjects, and later to neurological patients. His hypothesis was that the SMA is a key player in bimanual coordination. It turned out that the SMA is indeed involved, although not alone but in concert with the primary, premotor and cingulate motor areas.

In 1994, Mario Wiesendanger retired from his position as professor in Fribourg but remained as active as before by returning to the neurological clinic that motivated his entire career. He was appointed guest professor at the Department of Neurology of the University of Bern (Inselspital), Switzerland. Here he pursued his investigations of bimanual coordination in various patient groups, such as those with Parkinson’s disease, Huntington’s disease, cerebellar diseases, Tourette’s syndrome, etc. At the end of his career in the 2000’s, he successfully combined his two major passions, bimanual control and playing

the violin, by studying the sophisticated coordination of fingering (with the left hand) and bowing (with the right).

Overall, by 2011 Mario Wiesendanger had published nearly 200 publications, both original experimental studies and very rich and comprehensive reviews, highly valued in the motor control community. He was also a gifted writer of chapters of textbooks, that provided a solid basis for students.

His colleagues, students and friends remember him as a true multilingual and multicultural scholar. They admired his talent as a musician and as a creative scientist, along with his extremely vast knowledge of neurology both from the historical and contemporary points of view. He was fascinated by different cultures, with a focus on eastern European countries (Poland, Russia, Bulgaria, Armenia etc), where he collaborated with several laboratories and was of great help to scientists in these countries where the resources for research were limited. His career was a journey following the evolution of motor control from the traditions of neurology, anatomy, physiology and psychology to the current integration of all these fields in neuroscience. In some ways Mario Wiesendanger was a scientific adventurer and explorer! He consistently maintained a positive, constructive critical attitude, was not frightened of controversies, and defended his points of view with conviction. He was a highly recognized expert not only in his field of research but also in others areas, such as paleontology and rock drawings. However, he remained a modest person and was always pleasant and spiritual. For many scientists the time they spent with him will remain as one of the highlights of their scientific career.

Mario Wiesendanger was born on May 10<sup>th</sup>, 1931, as the son of Paul and Betty in Erlenbach, Switzerland. He married Rita Gisi, also a medical doctor and a researcher, and they had four daughters. He passed away on December 21<sup>st</sup>, 2017 in Bern. He is survived by his daughters, Cornelia, Katrin, Barbara and Eva, his seven grandchildren and two great-grandchildren.

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